1. Factor the polynomial below completely. Then, choose the intervals the zeros of the polynomial belong to, where $z_1 \leq z_2 \leq z_3$. *To make the problem easier, all zeros are between -5 and 5.*

$$f(x) = 8x^3 - 6x^2 - 45x - 27$$

A. $z_1 \in [-3.3, -1.7], \; z_2 \in [0.68, 0.83], \;$ and $\; z_3 \in [1.44, 1.51]$

B. $z_1 \in [-3.3, -1.7], \; z_2 \in [0.64, 0.69], \;$ and $\; z_3 \in [1.17, 1.48]$

C. $z_1 \in [-2.4, -1.4], \; z_2 \in [-0.77, -0.75], \;$ and $\; z_3 \in [2.78, 3.13]$

D. $z_1 \in [-3.3, -1.7], \; z_2 \in [0.3, 0.41], \;$ and $\; z_3 \in [2.78, 3.13]$

E. $z_1 \in [-1.4, -1.1], \; z_2 \in [-0.7, -0.63], \;$ and $\; z_3 \in [2.78, 3.13]$

---

2. Perform the division below. Then, find the intervals that correspond to the quotient in the form $ax^2 + bx + c$ and remainder r.

$$\frac{8x^3 - 8x^2 - 40x - 29}{x - 3}$$

A. $a \in [6, 12], \; b \in [14, 19], \; c \in [6, 9], \;$ and $\; r \in [-5, 2]$.

B. $a \in [6, 12], \; b \in [3, 10], \; c \in [-27, -22], \;$ and $\; r \in [-80, -72]$.

C. $a \in [6, 12], \; b \in [-32, -31], \; c \in [54, 57], \;$ and $\; r \in [-197, -193]$.

D. $a \in [24, 32], \; b \in [63, 69], \; c \in [152, 155], \;$ and $\; r \in [427, 428]$.

E. $a \in [24, 32], \; b \in [-83, -75], \; c \in [199, 207], \;$ and $\; r \in [-634, -628]$.

---

3. Perform the division below. Then, find the intervals that correspond to the quotient in the form $ax^2 + bx + c$ and remainder r.

$$\frac{6x^3 + 26x^2 - 28}{x + 4}$$

A. $a \in [1, 9], b \in [48, 55], c \in [200, 202], \;$ and $\; r \in [771, 774]$.

B. $a \in [1, 9], b \in [-4, 0], c \in [19, 28], \;$ and $\; r \in [-130, -124]$.

C. $a \in [1, 9], b \in [1, 5], c \in [-12, -4], \;$ and $\; r \in [-1, 10]$.

D. $a \in [-24, -22], b \in [-73, -66], c \in [-283, -279]$, and $r \in [-1154, -1140]$.

E. $a \in [-24, -22], b \in [121, 123], c \in [-491, -483]$, and $r \in [1921, 1929]$.

---

4. Factor the polynomial below completely. Then, choose the intervals the zeros of the polynomial belong to, where $z_1 \leq z_2 \leq z_3$. *To make the problem easier, all zeros are between -5 and 5.*

$$f(x) = 16x^3 - 40x^2 + x + 30$$

A. $z_1 \in [-2.25, -1.94]$, $z_2 \in [-1.04, -0.34]$, and $z_3 \in [0.79, 1.94]$

B. $z_1 \in [-1.34, -0.77]$, $z_2 \in [0.55, 0.88]$, and $z_3 \in [1.9, 2.19]$

C. $z_1 \in [-2.25, -1.94]$, $z_2 \in [-1.46, -1.14]$, and $z_3 \in [0.51, 0.89]$

D. $z_1 \in [-1.28, -0.5]$, $z_2 \in [1.07, 1.34]$, and $z_3 \in [1.9, 2.19]$

E. $z_1 \in [-5.28, -4.63]$, $z_2 \in [-2.05, -1.9]$, and $z_3 \in [-0.1, 0.58]$

---

5. Factor the polynomial below completely, knowing that $x - 4$ is a factor. Then, choose the intervals the zeros of the polynomial belong to, where $z_1 \leq z_2 \leq z_3 \leq z_4$. *To make the problem easier, all zeros are between -5 and 5.*

$$f(x) = 15x^4 - 59x^3 - 50x^2 + 208x - 96$$

A. $z_1 \in [-4, -3]$, $z_2 \in [-1.68, -1.66], z_3 \in [-0.81, -0.63]$, and $z_4 \in [1.7, 2.7]$

B. $z_1 \in [-2, 1]$, $z_2 \in [0.62, 0.9], z_3 \in [1.57, 1.69]$, and $z_4 \in [3.9, 5.2]$

C. $z_1 \in [-4, -3]$, $z_2 \in [-1.44, -1.27], z_3 \in [-0.67, -0.6]$, and $z_4 \in [1.7, 2.7]$

D. $z_1 \in [-4, -3]$, $z_2 \in [-3.02, -2.95], z_3 \in [-0.44, -0.14]$, and $z_4 \in [1.7, 2.7]$

E. $z_1 \in [-2, 1]$, $z_2 \in [0.55, 0.65], z_3 \in [1.28, 1.46]$, and $z_4 \in [3.9, 5.2]$

---

6. Perform the division below. Then, find the intervals that correspond to the quotient in the form $ax^2 + bx + c$ and remainder r.

$$\frac{12x^3 - 4x^2 - 40x + 37}{x + 2}$$

A. $a \in [-32, -22],\ b \in [-55, -47],\ c \in [-151, -142],$ and $r \in [-251, -245]$.

B. $a \in [-32, -22],\ b \in [36, 49],\ c \in [-129, -124],$ and $r \in [292, 296]$.

C. $a \in [12, 13],\ b \in [-32, -24],\ c \in [11, 19],$ and $r \in [4, 9]$.

D. $a \in [12, 13],\ b \in [-43, -38],\ c \in [79, 82],$ and $r \in [-205, -196]$.

E. $a \in [12, 13],\ b \in [18, 26],\ c \in [0, 1],$ and $r \in [29, 47]$.

---

7. Perform the division below. Then, find the intervals that correspond to the quotient in the form $ax^2 + bx + c$ and remainder r.

$$\frac{16x^3 - 48x - 28}{x - 2}$$

A. $a \in [32, 33], b \in [-64, -59], c \in [80, 83],$ and $r \in [-195, -187]$.

B. $a \in [12, 23], b \in [-35, -27], c \in [9, 21],$ and $r \in [-60, -53]$.

C. $a \in [12, 23], b \in [26, 33], c \in [9, 21],$ and $r \in [3, 5]$.

D. $a \in [32, 33], b \in [61, 67], c \in [80, 83],$ and $r \in [130, 141]$.

E. $a \in [12, 23], b \in [15, 17], c \in [-39, -28],$ and $r \in [-60, -53]$.

---

8. What are the *possible Integer* roots of the polynomial below?

$$f(x) = 2x^2 + 3x + 7$$

A. All combinations of: $\dfrac{\pm 1, \pm 2}{\pm 1, \pm 7}$

B. All combinations of: $\dfrac{\pm 1, \pm 7}{\pm 1, \pm 2}$

C. $\pm 1, \pm 7$

D. $\pm 1, \pm 2$

E. There is no formula or theorem that tells us all possible Integer roots.

---

9. Factor the polynomial below completely, knowing that $x - 4$ is a factor. Then, choose the intervals the zeros of the polynomial belong to, where $z_1 \leq z_2 \leq z_3 \leq z_4$. *To make the problem easier, all zeros are between -5 and 5.*

$$f(x) = 25x^4 - 80x^3 - 132x^2 + 224x - 64$$

A. $z_1 \in [-2, 2], \;\; z_2 \in [-0.17, 0.41], z_3 \in [0.76, 0.9], \;$ and $\; z_4 \in [3, 6]$

B. $z_1 \in [-5, -3], \;\; z_2 \in [-1.71, -0.25], z_3 \in [-0.63, -0.31], \;$ and $\; z_4 \in [1, 3]$

C. $z_1 \in [-5, -3], \;\; z_2 \in [-2.13, -1.06], z_3 \in [-0.19, 0.06], \;$ and $\; z_4 \in [1, 3]$

D. $z_1 \in [-2, 2], \;\; z_2 \in [1.21, 2.56], z_3 \in [2.4, 2.52], \;$ and $\; z_4 \in [3, 6]$

E. $z_1 \in [-5, -3], \;\; z_2 \in [-2.8, -2.06], z_3 \in [-1.34, -1.19], \;$ and $\; z_4 \in [1, 3]$

---

10. What are the *possible Integer* roots of the polynomial below?

$$f(x) = 6x^3 + 4x^2 + 4x + 7$$

A. $\pm 1, \pm 2, \pm 3, \pm 6$

B. All combinations of: $\dfrac{\pm 1, \pm 2, \pm 3, \pm 6}{\pm 1, \pm 7}$

C. $\pm 1, \pm 7$

D. All combinations of: $\dfrac{\pm 1, \pm 7}{\pm 1, \pm 2, \pm 3, \pm 6}$

E. There is no formula or theorem that tells us all possible Integer roots.
